CERTIFICATE OF VERIFICATION

I, Su Hyun LEE of 648-23 Yeoksam-dong, Kangnam-ku, Seoul, Korea state that the attached document is a true and complete translation to the best of my knowledge of the Korean-English language and that the writings contained in the following pages are correct English translations of the specifications and claims of the Korean Patent Application No. P2003-019579.

Dated this 13th day of September 2005

Signature of translator: _____

Su Hyun LEE

[ABSTRACT]

An LCD device with a digitizer and a method for manufacturing the same is disclosed, which has a stable insertion structure of a digitizer to an LCM, so as to obtain thin profile and lightness of the LCD device, and improve the yield, in which the LCD device with digitizer includes a support main receiving an LCD panel for displaying image, and a backlight for providing light to the LCD panel; a lamp for emitting light, provided at one side of the support main; a lamp housing surrounding the lamp, and having an opening; and a digitizer having one end thereof inserted to the opening of the lamp housing, and detecting coordinates of a predetermined point.

[TYPICAL DRAWINGS]

FIG. 4

[INDEX]

liquid crystal display device, digitizer, lamp housing

[SPECIFICATION]

[TITLE OF THE INVENTION]

LIQUID CRYSTAL DISPLAY DEVICE WITH DIGITIZER AND METHOD FOR MANUFACTURING THE SAME

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 is an exploded perspective view for illustrating a general LCM.

FIG. 2 is a block diagram for illustrating a driving circuit and method of a general electromagnetic EM type digitizer.

FIG. 3 is a schematic view for illustrating a digitizer mounted to an LCD device according to the related art.

FIG. 4 is a cross sectional view for illustrating a digitizer mounted to an incident part of an LCD device according to the present invention.

FIG. 5 is a cross sectional view for illustrating a digitizer mounted to an opposite side of an incident part of an LCD device according to the present invention.

Description of reference numerals for main parts in the drawings

12a: reflecting plate

13: support main

13a: ledge

26: lamp housing

40: digitizer

[DETAILED DESCRIPTION OF THE INVENTION]

[OBJECT OF THE INVENTION]

[FIELD OF THE INVENTION AND DISCUSSION OF THE RELATED ART]

The present invention relates to a liquid crystal display (LCD) device, and more particularly, an LCD device with a digitizer and a method for manufacturing the same.

With resolution of a liquid crystal display (hereinafter, referred to as "LCD") has been rapidly developed by an improvement of liquid crystal materials and micro fabrication technology with characteristics of lightweight, filed emission display and power consumption of electricity. Also, a range of application is becoming broader. As an example, the LCD is used as a display device of a notebook personal computer (hereinafter, referred to as "NTPC"). The NTPC is slim and lightweight to use information between users. Among video display devices applied to various display devices, particularly, a liquid crystal module (hereinafter, referred to as "LCM") including a backlight unit and a liquid display panel, which is a flat-panel display will be explained.

FIG. 1 is an exploded view of a general liquid crystal display module LCM 10. As shown in FIG. 1, the LCM 10 includes a backlight 12 and an LCD panel 11. The backlight 12 and the LCD panel 11 are supported by a support main 13 and a top case 20. At this time, a reflecting plate 12a, a light-guiding plate 12b, a first diffusing or protecting sheet 12c, a first prism sheet 12d, a second prism sheet 12e and a second diffusing or protecting sheet 12f are stacked up on top of the support main 13 of plastic material in order. Meanwhile, an upper side of the LCD panel 11 is connected to the top case 20 of the metal material, and a lower side of the LCD panel is supported by the support main 13. Herein, the backlight including the reflecting plate 12a, the light-guiding plate 12b and the sheets is a lower unit of the LCM 10 for uniformly irradiating light to the LCD panel.

Recently, high resolution of the LCD device is realized with a great improvement of LCD technology and a high-resolution graphic work is realized. Therefore, a digitizer is used as an input device in a computer having the aforementioned LCD device as well. The digitizer of the LCD device is classified into a resistive type, electrostatic capacitance type and EM (electro-magnetic) type according to the method of searching a user-directed location.

At this time, the resistive type senses a location being pressed by pressure through a change of an amount of an electric current in a condition that the direct current voltage is obtained. Also, the electrostatic capacitance type senses the pressed location by using capacitance coupling in a condition that the alternating current voltage is obtained. The electro-magnetic type sensed the pressed location by detecting a resonance frequency in a condition that a magnetic field is obtained.

Generally, the EM type digitizer is comprised of a digitizer plate having a sensor grid. In this case, a puck, a pen or a stylus is used to sense the location on the digitizer.

FIG. 2 is a block diagram illustrating a driving circuit and a driving method of an EM type digitizer according to the related art.

As shown in FIG. 2, a digitizer plate (hereinafter, referred to as a 'digitizer') 40 includes X-axis and Y-axis coil arrays and X-MUX and Y-MUX coupled to the X-axis and Y-axis, respectively. A specified Y-axis coil is selected by a Y address signal (Y-ADDR), a specified X-axis coil is selected by an X address signal (X-ADDR) for reading. Both X and Y address signals are generated from the controller 15.

The output signals from the selected Y-axis coil and X-axis coil are provided to the controller 15. The controller 15 includes an amplifier 34 for grading and

amplifying the output signals, a wave detector 35, a low pass filter LPF 36, a sample and hold unit S/H 37, and an analog-digital converter 38. At this time, the output signals of the amplifier 34 are provided to the analog-digital converter 38 through the wave detector 35, the low pass filter 36 and the sample and hold unit 37.

The analog-digital converter 38 converts the size and polarity of an analog signal to a digital format, and then outputs the digital format to a processor 33.

The output signal of the amplifier 34 is supplied to the wave detector 35, and then supplied to the low pass filter 36 and the sample and hold unit 37.

While the analog-digital converter 38 is digitizing, the sample and hold unit 37 holds a measured value of a coil and a second following coil measurement is started at a front circuit.

The digitizer 40 includes a plurality of coils being piled up on a flexible surface of the PCB. Each coil is arrayed against X-axis and Y-axis, and has a first side being connected to a grounding voltage and a second side being connected to a mux unit in which one coil is chosen to be connected to an electric potential line of a fixed level.

In a hand-in state with an electronic pan 39 by a user, a sine wave current 32 is generated from a sine wave generator 31 under control of the processor 33, and then the sine wave current 32 is applied to the electronic pan 39, whereby a sine wave magnetic flux generates around the electronic pan 39.

At this time, when the user positions the electronic pan 39 on the digitizer 40, each sine wave voltage in different sizes is induced to each coil arranged on the digitizer 40 according to the position of the electronic pan 39, whereby the sine wave voltage is inputted to a CPU through the wave detector 35 and the analog-digital converter 38.

After that, the CPU 33 calculates the value of the position of the electronic

pen 39 on the digitizer 40 from the value induced to a coil and outputs the angle value between 0°and 360°. The output data of the electronic pen 39 is induced to the liquid crystal display panel or stored in the CPU.

It is more convenient for a user to draw a figure when an area of the electromagnetic digitizer is larger and more efficient when the resolution is higher. The resolution is inverse proportion to spaces between coils in the digitizer 40. That is, when the spaces between the coils are narrower, the resolution becomes higher.

In the EM type, a plurality of coils are provided inside the digitizer 40, so that it is possible to detect the touching point of the electron pen 39 by detecting electric changes. Accordingly, unlike the resistive type, it is not required to mount the digitizer at the front of the LCD panel in the EL type. That is, the digitizer of the EM type may be mounted at the rear of the LCM 10. In case the LCM 10 having electromagnet connection characteristics is formed, it is possible to detect the touching point of the electron pen even though the digitizer 40 is positioned below the LCM 10.

In general, a printed circuit board (hereinafter, referred to as PCB) is provided at the bottom of the support main in the rear of the LCD device. A drive integrated circuit (hereinafter, referred to as D-IC) for driving switching devices (TFT array) of the LCM 10 on the PCB. And, the LCM 10 and the PCB having the D-IC are electrically connected by a tape carrier package (hereinafter, referred to as TCP) so as to send a control signal of the D-ICs (a gate line driving signal) and a video signal (a data line driving signal) to each gate and data line of the LCD panel.

When the digitizer is provided at the rear of the LCM, it is desirable that the electro-magnetically uniform LCM is arrayed on a top surface of the digitizer and materials not being an electro-magnetically uniform formed in an irregular form such as

PCB is provided on a lower surface of the digitizer.

FIG. 3 schematically illustrates the digitizer mounted at the rear of the LCM.

As shown in FIG. 3, when assembling a digitizer in a Table PC (EM Type) according to the related art, the digitizer is inserted between a support main 13 provided at the rear of the LCM and S,G-PCB (45, Source, Gate Printed Circuit Board) after the LCM 10 is assembled. When inserting the digitizer, as shown in FIG. 3, the digitizer should be lifted upward and fix the digitizer at a place to reduce a damage of the S,G-PCB 45 and the TCP 14.

When the digitizer 40 is fixed, in case of having S,G PCB 45, as the inserted digitizer is in contact with the S,G-PCB 45 and the TCP, thereby increasing the damages. Also, when the PCB 45 and the TCP 14 are lifted to insert the digitizer, the TCP 14 connected to the PCB 45 is contacted with the top case 20 and cracked. Particularly, the number of inferior goods are increased when having the S,G-PCB 45. Furthermore, in case an end of the top case 20 has a burr having a kin end because an end of a top case contacting with the TCP is inferior, the damage of the TCP is accelerated.

Also, the PCB is screwed remaining a predetermined space between the support main and the PCB so as to insert the digitizer into the space according to a conventional art.

[TECHNICAL TASKS TO BE ACHIEVED BY THE INVENTION]

However, the related art LCD with digitizer has the following problems.

In case of the related art, it requires the additional space for screw fixation to LCM, whereby the size of LCD increases. That is, it causes the problem in the LCD device for requiring the thin profile and lightness.

When inserting the digitizer between the LCM and the PCB, the PCB is lifted. Also, on insertion of the digitizer, the PCB and the TCP are damaged, thereby increasing the inferior goods.

Accordingly, the present invention is directed to an LCD device with a digitizer that substantially obviates one or more problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide an LCD device having a stable insertion structure of a digitizer to an LCM, which is suitable for obtaining thin profile and lightness of the LCD device, and improving yield.

[PREFERRED EMBODIMENTS OF THE INVENTION]

To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, an LCD device with a digitizer includes a support main receiving an LCD panel for displaying image, and a backlight for providing light to the LCD panel; a lamp for emitting light, provided at one side of the support main; a lamp housing surrounding the lamp, and having an opening; and a digitizer having one end thereof inserted to the opening of the lamp housing, and detecting coordinates of a predetermined point.

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

An LCD device with a digitizer and a method for manufacturing the same according to the present invention will be described with reference to the accompanying

drawings. The LCD device according to the present invention includes a support main, a lamp, a lamp housing, and a digitizer having one end inserted to an opening of the lamp housing to detect coordinates of a touching point.

FIG. 4 is a cross-sectional view illustrating a portion adjacent to a lamp housing 26 of an LCD device with a digitizer 40 according to the present invention, in which a portion of a support main 13, to which a lamp 25 is mounted, is referred to as an incident part, and an opposite side is referred to as an opposite-incident part.

As shown in FIG. 4, the lamp 25 is provided at one side of the support main 13 along a long-axis direction of an LCM 10. Generally, the lamp 25 is a cold cathode fluorescent lamp (CCFL). That is, the lamp 25 emits light, and then the light is reflected to an upper side by a reflecting plate 12a without light leak to the external. Also, a light-reflecting process is performed to an inner surface of the lamp housing 26 surrounding the lamp 25. Then, a light-guiding plate 12b is provided on the reflecting plate 12a for uniformly emitting the incident light to the upper side. Subsequently, the light emitted from the light-guiding plate 12b passes through a plurality of sheets 12 such as a diffusion sheet, a protecting sheet, and a prism sheet, and then the light is incident on the LCD panel 11, thereby displaying a desired picture image.

The digitizer 40 according to the present invention is different from a digitizer according to the related art in that the digitizer 40 according to the present invention is not provided at the rear of the LCM 10. That is, the digitizer 40 according to the present invention is assembled in a state of inserting one end thereof to an opening of the lamp housing 26 when assembling the backlight of the LCM 10. At this time, the digitizer 40 is a sensor detecting coordinates of a touching point of an electron (stylus) pen in an electromagnetic EM mode.

Referring to FIG. 4, the lamp housing 26 has the opening at a portion adjacent to the light-guiding plate 12b, whereby the light is effectively incident on the light-guiding plate 12b. At this time, one end of the digitizer 40 is inserted into the opening of the lamp housing 26, and the reflecting plate 12b is provided on the digitizer 40. Also, the light-guiding plate 12b is provided on the reflecting plate 12a. Herein, each one end of the light-guiding plate 12b, the reflecting plate 12a and the digitizer 40 is inserted to the opening of the lamp housing 26. Thus, it is required to maintain the digitizer inserted into the opening of the lamp housing 26 at a correct position not to be moved by an external force. That is, each one end of the light-guiding plate 12b, the reflecting plate 12a and the digitizer 40 is inserted to the opening of the lamp housing 26, whereby the digitizer 40 is clamped by the lamp housing 26. As a result, it is possible to fix the light-guiding plate 12b, the reflecting plate 12a and the digitizer 40 stably. In order to clamp the light-guiding plate 12b, the reflecting plate 12a and the digitizer 40 with the lamp housing 26, the lamp housing 26 is formed of a metal material having stiffness and elasticity. For example, the lamp housing 26 is formed of stainless steel or aluminum. However, it is possible to form the lamp housing 26 with any other material having stiffness and elasticity.

As shown in FIG. 4, the plurality of sheets 12 are deposited on the clamped light-guiding plate 12b for forming light-path by concentrating the light emitted from the light-guiding plate 12b to the upper side. Then, the LCD panel 11 is provided on the plurality of sheets 12. At this time, polarizing plates are respectively provided on upper and lower surfaces of the LCD panel 11.

In the structure for mounting the digitizer 40 according to the present invention, one end of the digitizer 40 is inserted into the lamp housing 26. In this

respect, it is necessary to prevent the light from leaking at a contact portion between the digitizer 40 and the lamp housing 26. Also, the light may leak at a contact portion between the digitizer 40 and the reflecting plate 12a. Accordingly, referring to FIG. 4, a supplementary reflecting plate 27 is provided in a portion, to which the light of the lamp 25 is directly irradiated, at one end of the digitizer 40 inserted to the lamp housing 26, for preventing the light from leaking. The supplementary reflecting plate 27 is formed of the same material as that of the reflecting plate 12a. According to the above-mentioned method, the digitizer 40 is mounted at the incident part of the LCD device according to the present invention.

Hereinafter, a structure for mounting the digitizer 40 at an opposite side of the incident part will be described with reference to FIG. 5.

FIG. 5 is a cross-sectional view illustrating an opposite-incident part of the LCD device according to the present invention. As shown in FIG. 5, a ledge (extension) 13a is provided in the support main 13 at an opposite side of the incident part, for fixing the digitizer 40. The ledge 13a is extended from a bottom of the support main 13, whereby the ledge 13a serves as a supporter for the digitizer 40. Also, the ledge 13a compensates a thickness extended from a bottom of the lamp housing 26 at the incident part. That is, the ledge 13a has the same thickness as that of the lamp housing 26.

More specifically, the stable structure of the digitizer 40 will be described as follows. In the incident part, the digitizer 40 is clamped by the opening of the lamp housing 26, and the lamp housing 26 is fixed to one side of the support main 13. In the opposite-incident part, each end portion of the digitizer 40, the reflecting plate 12a, the light-guiding plate 12b and some sheets is inserted between the ledge 13a of the support

main 13 and a panel supporter 13b, and then fixed therebetween.

For the stable fixation, the ledge 13a is integrated with the support main 13. Preferably, the ledge 13a is provided along the bottom of the support main 13 at a longitudinal direction to obtain the stable fixation.

Next, a method for manufacturing the LCD device with the digitizer 40 according to the present invention will be described with reference to FIG. 3.

First, the lamp housing 26 surrounding the lamp 25 is provided at one side of the support main 13. At this time, the lamp housing 26 has the opening at the portion adjacent to the light-guiding plate 12b. After that, each one end of the light-guiding plate 12b and the digitizer 40 is inserted to the opening of the lamp housing 26. Also, the plurality of sheets 12 are provided at the upper side of the lamp housing 26 for forming the light-path, thereby completing the assembly of the backlight. Then, the LCD panel 11 is provided above the lamp housing 26, and the PCB connected to the LCD panel 11 is provided at the rear of the support main 13. Subsequently, a top case 20 covers the upper surface of the LCD panel 11, thereby completing the LCM 10 having the digitizer 40 in the backlight thereof.

In the LCD device having the digitizer 40 according to the present invention, the digitizer 40 is previously assembled into the backlight, so that is it not required to lift up the PCB 45 for mounting the digitizer 40 therein.

[ADVANTAGES OF THE INVENTION]

As mentioned above, the LCD device with the digitizer according to the present invention has the following advantages.

First, the digitizer is directly mounted and fixed to the backlight of the LCM, so that it is not required to obtain an extra space for an additional screw coupling to mount the digitizer at the rear of the LCM. As a result, it is possible to obtain the thin profile and the lightness of the LCD device according to the present invention.

Furthermore, the digitizer is previously assembled into the backlight when assembling the backlight. That is, it is not required to lift up the PCB and TCP for mounting the digitizer at the rear of the LCM, thereby preventing the PCB and TCP from being damaged.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An LCD device with a digitizer comprising:

a support main receiving an LCD panel for displaying image, and a backlight for providing light to the LCD panel;

a lamp for emitting light provided at one side of the support main;

a lamp housing surrounding the lamp, and having an opening; and

a digitizer having one end inserted to the opening of the lamp housing, and detecting coordinates of a predetermined point.

2. The LCD device of claim 1, wherein the digitizer is a sensor for detecting the coordinates of the predetermined point in an Electromagnetic mode.

3. The LCD device of claim 1, wherein the backlight includes:

a light-guiding plate provided to be adjacent to the lamp for uniformly irradiating the light emitted from the lamp to an upper side; and

a reflecting plate provided at a lower surface of the light-guiding plate, for reflecting the light emitted from the lamp to the upper side.

4. The LCD device of claim 3, wherein the lamp housing is formed of a metal material having stiffness and elasticity.

5. The LCD device of claim 4, wherein each one end of the light-guiding plate, the reflecting plate and the digitizer is inserted to the opening of the lamp housing, and

then clamped to be fixed by the lamp housing.

6. The LCD device of claim 1, wherein a supplementary reflecting plate is provided in a portion, to which the light of the lamp is directly irradiated, at one end of the digitizer inserted to the lamp housing, for preventing the light from leaking.

7. The LCD device of claim 1, wherein a ledge is formed in the support main at an opposite side of the lamp housing, for fixing the digitizer.

8. The LCD device of claim 7, wherein the ledge has the same thickness as that of the lamp housing.

9. A method for manufacturing an LCD device with a digitizer comprising:

a first step for adhering a lamp housing surrounding a lamp as a light source to one side of a support main;

a second step for inserting each one end of a reflecting plate, a digitizer and a light-guiding plate to an opening of the lamp housing; and

a third step for depositing a plurality of sheets and an LCD panel to form light-path by guiding light to an upper side of the lamp housing.

10. The method of claim 9, wherein the reflecting plate, the digitizer and the light-guiding plate, inserted in the second step, are clamped by the lamp housing.

FIG. 1

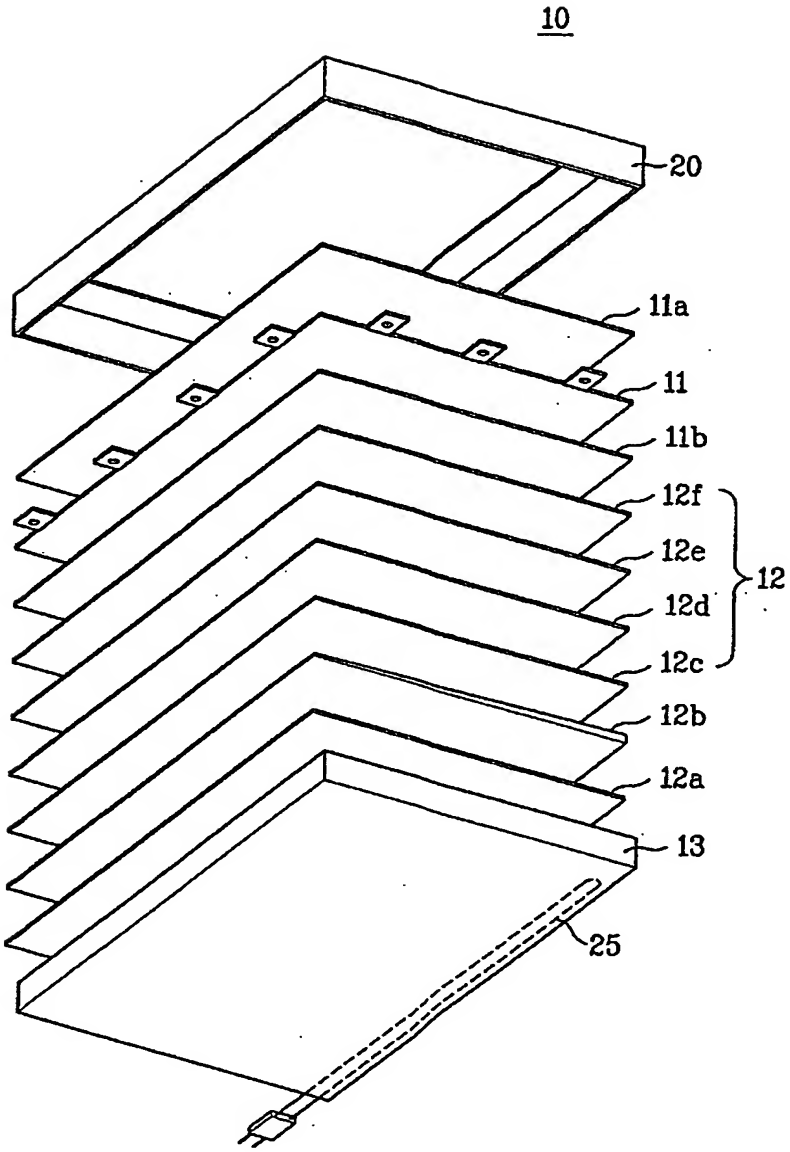

FIG. 2

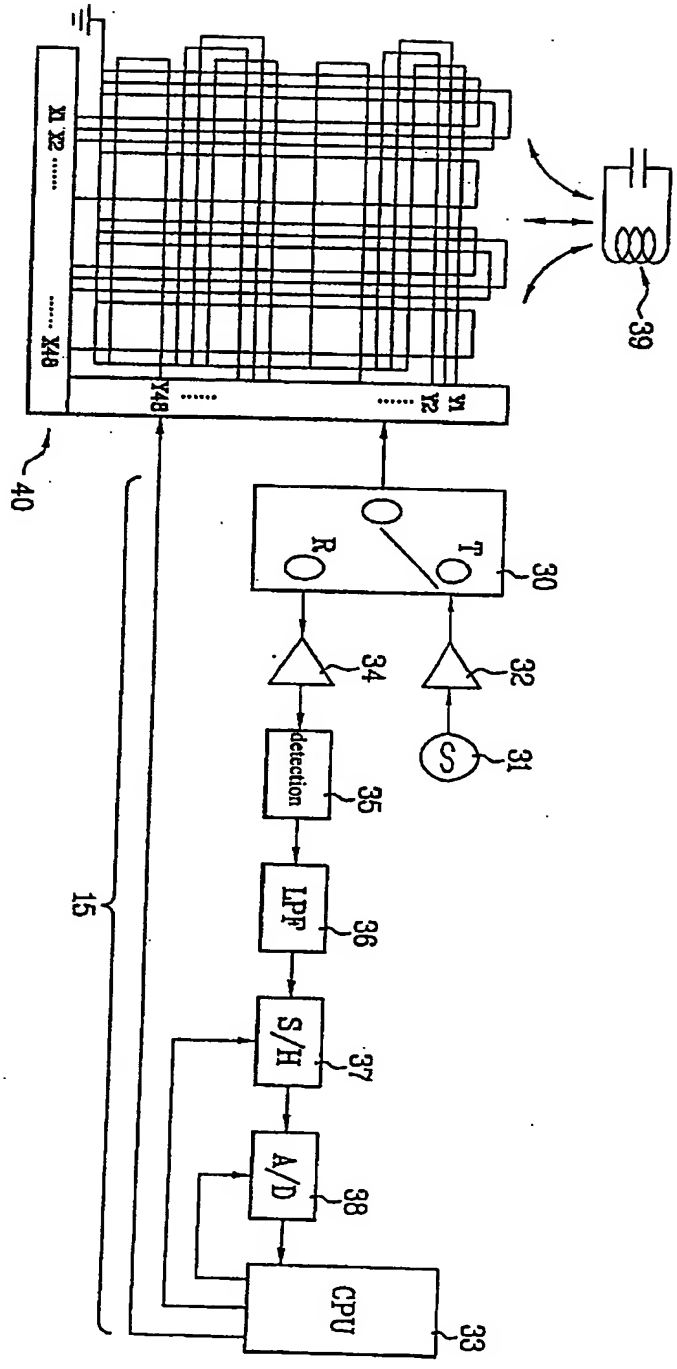
X1 X2 ..... X48
Y48 ..... Y2 Y1
39
40
R
T
30
34
32
S
31
detection
35
LPF
36
S/H
37
A/D
38
CPU
33
15

FIG. 3

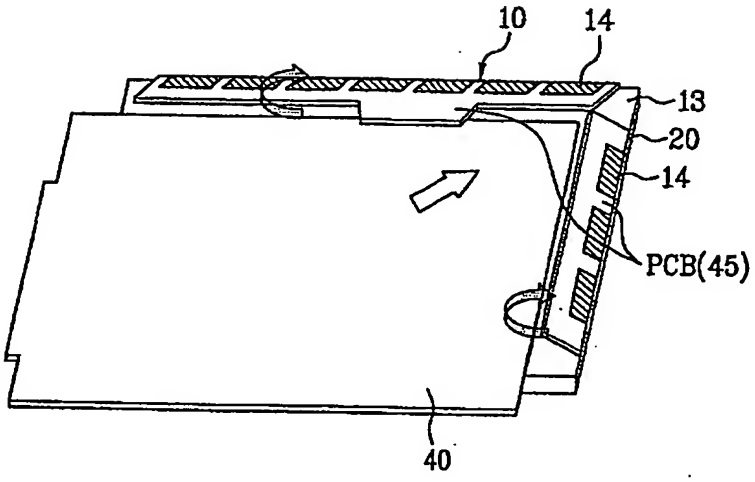

FIG. 4

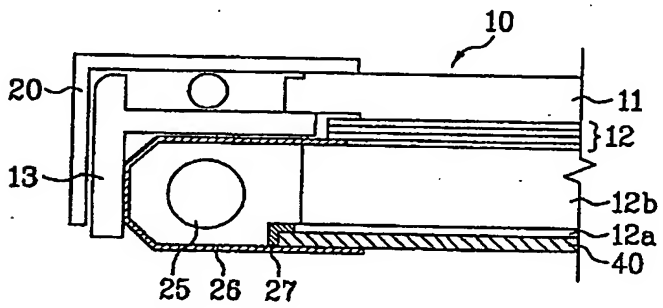

FIG. 5